

Docket No.: YOM-0099

REMARKS

Claims 15-36 are pending in the present Application. Claim 30 has been canceled, claims 15, 19, 24, and 25 have been amended, and no claims have been added, leaving Claims 15-29 and 31-36 for consideration upon entry of the present Amendment.

Claim 15 has been amended to include an average particle diameter size limitation for the crystalline polycarbonate of 80 to 3,000 μm , and a variation in average particle diameter of less than 20%. Support for this amendment can be found at least in the specification as published in PCT international publication no. WO 2004/041906 A1 on page 14, line 14 to page 15, line 2.

Claim 19 has been amended to incorporate the limitations of claim 30. Accordingly, claim 30 is canceled herewith.

Claim 24 has been amended to correct an inadvertent typographical error, and to conform to current Markush group wording. The scope of the claims has not been narrowed thereby.

Claim 25 has been amended to correct an inadvertent typographical error.

No new matter has been introduced by these amendments. Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 102(b)

Claim 19 stands rejected under 35 U.S.C. § 102(b), as allegedly anticipated by US 5,717,056. Applicants respectfully traverse this rejection. Claim 19, as amended, requires spraying the amorphous polycarbonate precursor through a nozzle in the upper portion of a solid state polymerization reactor. There appears to be no teaching or suggestion related to this positively recited step in the cited reference. Claim 19 as amended is therefore novel over US 5,717,056, and consideration of any differences in molecular weights between the reference and the claims is rendered moot. Reconsideration and withdrawal of the rejection is respectfully requested.

Docket No.: YOM-0099

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 15-25, 27-32, 35, and 36 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over US 5,717,056 or US 4,948,871 in view of JP 2000-080171. According to the Examiner, US 5,717,056 and US 4,948,871 each discloses preparation of a low molecular weight precursor polycarbonate; conversion of the precursor polycarbonate to a higher crystallinity precursor by various means; and production of a high molecular weight polycarbonates using a solid state process. The Examiner notes that neither of these references discloses the specific type of drying chamber or spray drying method as claimed by applicants. (Office Action, p. 3, last ¶) However, the Examiner states that it would have been obvious from JP 2000-080171 to use a spray-drying process, in that spray drying is known to be a relatively stable process for producing polycarbonates. (Office Action, p. 4, 1st ¶)

Applicants respectfully traverse this rejection. With respect to independent claim 15, the polycarbonate precursor used in the solid state polymerization process has particles having an average diameter of 80-3,000 micrometers and a variation in particle diameter distribution of less than 20%. Neither of US 5,717,056 nor US 4,948,871 discloses or suggests obtaining this particle size and particle size distribution prior to solid state polymerization. Furthermore, the spray-drying process of JP 2000-080171 discloses obtaining polymer particle sizes of less than 0.5 micrometers. (See Claim 4 of JP 2000-080171).

None of the cited references discloses or suggests this claim limitation, or recognize its importance. The prior art processes yield low molecular weight starting materials, and require long processing times. As stated in the present Specification, the maximum molecular weight obtained using the processes of the cited art is, at most, 38,800 g/mol after more than 8 hours of solid state polymerization. (Specification, p. 4)

Use of a polycarbonate precursor having the claimed particle sizes and distribution, on the other hand, prevents over- or under-crystallization, allows proper nitrogen input and pressure conditions during polymerization, and produces a polycarbonate with improved physical properties. (Specification, p. 14, line 14 to page 15, line 2) It also permits production of higher molecular weight polycarbonates with improved polydispersity, compared to processes where the precursor polycarbonate is merely crystallized from solution,

Docket No.: YOM-0099

rather than spray-dried. Examples 1, 2, and 3 of the present invention use spray-dried polycarbonate precursor particles having an average diameter of 300 ± 27 , 350 ± 31 , and 350 ± 31 micrometers, respectively, to produce polycarbonates having a weight average molecular weight of 31,751, 101,751, and 102,800 g/mol, respectively, and a polydispersity index of 1.94, 2.01, and 2.01, respectively. Comparative example 1 use recrystallized polycarbonate precursor particles. The particles produced in Comparative Example 1 had an average diameter of 550 microns, with lumps exceeding 10 mm, and thus had to be pulverized to be used in solid state polymerization. Even so, the polycarbonate produced from this material had a molecular weight of only 30,072 g/mol, a polydispersity index of 2.26, and a large molecular weight distribution.

Further with respect to claim 19, none of the cited documents discloses a process wherein the polycarbonate precursor is crystallized simultaneously with addition of the crystallized product to the solid state reaction chamber. (This is the result of spraying the amorphous polycarbonate from a nozzle in the upper portion of the chamber, as presently claimed.) JP 2000-080171, in contrast, discloses spray drying in order to prepare (isolate) resin granules.

Example 3 shows that it has unexpectedly been found that spray-drying directly into the reaction chamber also allows production of high molecular weight polycarbonates (e.g., 102,800 g/mol) with a low polydispersity index (e.g. 2.01). Comparative Example 3, where the precursor polycarbonate was prepared by a separate crystallization process, resulted in a polycarbonate having a weight average molecular weight of only 31,751 g/mol and a polydispersity index of 2.26. In addition, Figure 3 shows that by combining these processes (as presently claimed), as significant time savings can be achieved in the second stage of polymerization. For example, it can be seen from Figure 3 that a polycarbonate having a molecular weight of about 40,000 g/mol can be obtained in about 2 hours, and a molecular weight of about 100,000 g/mol can be obtained in about 15 hours using the present process, whereas 15 hours is required to obtain a molecular weight of about 32,000 g/mol in the prior art processes.

Docket No.: YOM-0099

For an obviousness rejection, it must be established, *inter alia*, that the prior art discloses all limitations of the claims, and that the proposed modification of the prior art had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996). Here, the cited art does not disclose or suggest use of a particular average particle size and distribution as claimed, or the use of a crystallization process that occurs within the solid state reactor. The cited art further does not disclose or suggest the advantages of use of a spray drying process in accordance with the claims, i.e., the production of high molecular weight polycarbonates having a low polydispersity index, with a significant reduction in the time required for polymerization. The present independent claims (claims 15 and 19) are therefore not obvious over the cited art. The remaining claims are also not obvious, as depending from allowable independent claims. Reconsideration and allowance of the claims is therefore requested.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

CANTOR COLBURN LLP

By: 

Jae Y. Park

Limited Recognition No. L0077

Cantor Colburn LLP

55 Griffin Road South

Bloomfield, CT 06002

Telephone: (860) 286-2929

Fax: (860) 286-0115

PTO Customer No. 23413

Date: April 25, 2006